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EXAMINER

TRAN, KHANH C

ART UNIT PAPER NUMBER

2631

DATE MAILED: 08/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

**Application No.**

09/912,068

**Applicant(s)**

ZHANG ET AL.

**Examiner**

Khanh Tran

**Art Unit**

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 19 May 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-48 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-3, 12, 15-24, 27, 35 and 39-46 is/are rejected.
- 7) ☒ Claim(s) 4-11, 13, 14, 25, 26, 28-34, 36-38, 47 and 48 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on 30 January 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
- 1) ☒ Certified copies of the priority documents have been received.
  - 2) ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - 3) ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |                                                                                                                        |                                                                                         |
|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                            | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____                                                |

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### **DETAILED ACTION**

1. The Amendment filed on 05/19/2005 has been entered. Claims 1-48 are pending in this Office action.

### ***Response to Arguments***

2. Applicant's arguments with respect to claims 1-3, 15, 17, 20-23, 27, 39 and 42-45 have been considered but are moot in view of the new ground(s) of rejection.

3. The objection of the Drawings has been withdrawn after Applicant clarifies the drawings.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1-3, 15-17, 20-23, 27, 39 and 42-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jin U.S. Patent 6,671,327 in view of John G. Proakis "Digital Communications", third edition, 1995.

Regarding claims 1 and 27, Jin discloses in the abstract of the cited US patent a method for transmitting data over a communications channel.

In regarding to the claimed step of "dividing said sequence of information bits into encoding bits and parallel bits", as shown in one embodiment in figure 3, input bits arrive in parallel, wherein a portion of an incoming bit stream is fed to encoder data block 10. As result of that, the foregoing disclosure impliedly addresses the claimed step, see column 2, lines 43-49.

In regarding to the claimed step of "encoding said encoding bits to produce encoded bits", as recited above, a portion of an incoming bit stream is fed to encoder data block 10. Outputs from data block 10, comprising three bits  $u_1 u_2 u_3$  and three bits  $u'_1 u'_2 u'_3$  are passed through turbo encoder 20 to produce encoded bits.

In regarding to the claimed step of "mapping said encoding bits and parallel bits into first and second pulse amplitude modulation (PAM) signals", Jin does not expressly teach the step of mapping as set forth in the claim. However, Jin expresses that a constellation encoder structure employed is similar to that used in an ADSL system in which a quadrature amplitude modulation (QAM) modulator is usually employed. In column 2 line 62 via column 3 line 40, Jin further teaches the binary word  $u$  determines two binary words  $v$  and  $w$ , which are used to look up two constellation points (e.g.  $x$  and  $y$  bits as shown in figures 6 and 7) in the encoder look-up table.

John G. Proakis discloses on pages 178-179 in the textbook "Digital Communications", third edition, 1995, quadrature amplitude modulation (QAM) is a result of simultaneously impressing two separate  $k$ -bit symbols from the information sequence on two-quadrature carriers  $\cos 2\pi f_c t$  and  $\sin 2\pi f_c t$ . In view of that, it would have been obvious for one of ordinary skill in the art at the time of the invention

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that Jin teachings can be modified to map the encoded bits and parallel bits into first and second PAM signals. Motivation is that Jin teachings apply to ADSL system in which a quadrature amplitude modulation (QAM) modulator is usually employed. Furthermore, figures 6 and 7 show the constellation how the final three bits are mapped and the constellation showing how the determination of the most significant bits.

Regarding claim 2, the modulation scheme taught in Jin invention is for transmitting data over a communication channel. As a result of that, the method in claim 1 further includes a step of transmitting a QAM signal over a communication channel.

Regarding claim 3, Jin invention is directed to a modulation scheme for transmitting data over a communication channel, in a discrete multi-tone modulation (DMT) system. Jin further teaches that the constellation encoder structure employed is similar to that used in an ADSL system. Because Jin teachings reference the modulation scheme to DSL modulation system and ADSL system, it would have been obvious for one of ordinary skill in the art at the time the invention was made that Jin invention can be implemented in ADSL communication system.

Regarding claim 15, figure 1 shows the encoding is performed by Turbo encoder.

Regarding claim 16, referring to figure 1, encoding is performed by multiple encoders 12 14.

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Regarding claims 17 and 39, the turbo encoder in figure 1 is a serial concatenated turbo encoder.

Regarding claims 20 and 42, figure 3 illustrates the encoded bit form a binary word  $w$ , and the unencoded bits form another binary word  $u$ , which are used to look up two constellation points, corresponding to the claimed forming a first vector and a second vector.

Regarding claims 21 and 43, in column 2, line 63 through column 3 line 2, Jin discloses the two binary words  $v$  and  $w$  used to look up two constellation points. In view of that, the binary words are mapped into the first PAM signal and second PAM signal as recited in claim 1.

Regarding claims 22 and 44, shown in figure 3,  $w$  only includes encoded bits and  $v$  only includes parallel bits. Hence, each of the first PAM signal and second PAM signal is formed from alternate ones of the encoded bits and parallel bits.

Regarding claims 23 and 45, in column 1 lines 61-65, Jin teaches that the turbo coder is preferably used to code only the least significant bit (LSB) in the constellation. In view of that, alternating ones of encoded bits form least significant bits, and alternate ones of parallel bits form most significant bits of each of PAM signals.

5. Claims 12 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jin U.S. Patent 6,671,327 and John G. Proakis "Digital Communications", third edition, 1995 as applied to claims 1 and 27 above, and further in view of Markarian et al. U.S. Patent 6,553,539 B1.

Regarding claims 12 and 35, Jin and John G. Proakis do not expressly disclose the encoded bits consist of systematic bits and parity bits. Jin utilizes a turbo encoder in figure 1. By definition, Turbo codes are parallel-concatenated recursive systematic convolutional codes. In view of that, the encoded bits consist of systematic bits. Furthermore, Markarian et al. discloses in column 2 lines 1-8, turbo encoder encode input word to generate corresponding bits and parity bits. As a result of that, it would have been obvious for one of ordinary skill in the art at the time the invention was made that Turbo encoder produces systematic bits and parity bits. There is no need to state a motivation here because Turbo encoder inherently produces systematic bits and parity bits.

6. Claims 24 and 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jin U.S. Patent 6,671,327 and John G. Proakis "Digital Communications", third edition, 1995 as applied to claim 1 above, and further in view of Gelblum et al. U.S. Patent 6,088,387.

Regarding claims 24 and 46, Jin and John G. Proakis disclose all the claimed limitations, but do not teach mapping is a concatenated Gray mapping. Gelblum et al. teaches a similar apparatus for implementing turbo code and trellis code modulation in a

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multi tone communications environment. Figure 1 illustrates a modem in which a portion of information bits is turbo coded and the other information bits are uncoded. Referring to figure 2, in column 5 lines 37-45, the assignments of bits to the M-QAM symbols can employ any suitable mapping scheme as Gray mapping, which is well known in the art. Because of the known potential advantage of Gray mapping, one of ordinary skill in the art would have been motivated to implement Gray mapping into Jin system.

7. Claims 18 and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jin U.S. Patent 6,671,327 in view of John G. Proakis "Digital Communications", third edition, 1995 as applied to claim 1 and further in view of David G. Williams, "**Turbo product codes and their bandwidth efficiency**", IEEE Colloquium on 22 Nov. 1999  
Page(s): 6/1 – 629.

Regarding claim 18, Jin does not teach that encoding is performed by a turbo product code encoder as claimed in the application claim.

David G. Williams discloses on page 1 the Turbo Product Codes providing excellent means of improving bandwidth efficiency. Jin teaches using a turbo encoder to generate turbo encoded output bits. As discloses on page 1, David G. Williams discloses Turbo Product Codes are extension of Turbo codes; therefore, it would have been obvious for one of ordinary skill in the art at the time of the invention that Jin teaching can be modified to use Turbo Product Codes as taught in David G. Williams' paper. Motivation is described on the paper that



Turbo Product Codes providing excellent means of improving bandwidth efficiency.

8. Claim 19 and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jin U.S. Patent 6,671,327 in view of John G. Proakis "Digital Communications", third edition, 1995 as applied to claim 1 and further in view of Lentmaier, M.; Zigangirov, K.S. **"Iterative decoding of generalized low-density parity-check codes"**, Information Theory, 1998. Proceedings. 1998 IEEE International Symposium on 16-21 Aug. 1998 page(s): 149.

Regarding claims 19 and 41, Jin does not teach that encoding is performed by a low-density parity check (LDPC) encoder as claimed in the application claim.

Lentmaier, M. and Zigangirov, K.S. teach the use of low-density (LD) parity-check codes in combination with iterative decoding. Lentmaier, M. and Zigangirov, K.S. further expresses that LDPC are promising for achieving low error probabilities at a reasonable cost. Therefore, therefore, it would have been obvious for one of ordinary skill in the art at the time of the invention that Jin teaching can be modified to use LDPC as taught in Lentmaier, M. and Zigangirov, K.S.'s paper.

***Allowable Subject Matter***

9. Claims 4-11, 13-14, 25-26, 28-34, 36-38, and 47-48 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in

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independent form including all of the limitations of the base claim and any intervening claims.

### ***Conclusion***

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Sasaki U.S. Patent 5,408,499 discloses "Multilevel Code For Transmission Device".

Herzberg U.S. Patent 5,970,098 discloses "Multilevel Encoder".

Wei U.S. Patent 6,473,878 discloses "Serial-Concatenated Turbo Codes".

Kim et al. U.S. Patent 6,374,386 discloses "Device And Method For Inserting Previously Known Bits In Input Stage Of Channel Encoder".

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khanh Tran whose telephone number is 571-272-3007. The examiner can normally be reached on Monday - Friday from 08:00 AM - 05:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mohammad Ghayour can be reached on 571-272-3021. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

KCT

*Khanhcong Tran*

*08/02/2005*

Examiner KHANH TRAN